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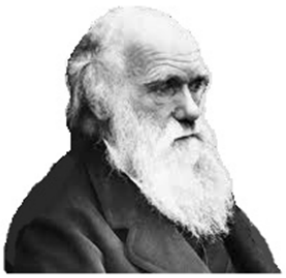

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Comparative Analysis of The Mineral Elements Constituent of *Cola millenii* K. Schum and *Blighia sapida* K.D. Koenig

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ABSTRACT

Limited information on the mineral elements constituent of ackee *Blighia sapida* K.D. Koenig and *Cola millenii* K. Schum are responsible for the underutilization of parts of this tree for health benefit purposes in West Africa. This study comparatively investigated the mineral nutrient content of both *B. sapida* and *C. millenii* pods. The results of the mineral element composition revealed that ackee (*B. sapida*) pod is high in Na 1.325%, Ca 0.032%, Mg 0.033%, P 0.017%, and K 0.077%, compared to *C. millenii* with Na 0.663%, Ca 0.019%, Mg 0.013%, P 0.004%, and K 0.013%, respectively. We also noted that the pods of *B. sapida* are rich in Fe 0.135%, when compared to 0.045% of Fe present in *C. millenii* pods. In contrast, *C. milleni* pods are rich in Cu 0.086% when compared to *B. sapida* pods at 0.054%. Also *C. milleni* pods contain Mn 0.001%, Zn 0.006%, Pd 0.006%, Cr 0.0002% and Cd 0.00002% while *B. sapida* contains Mn 0.003%, Zn 0.005%, Pd 0.004%, Cr 0.003%, and Cd 0.00008%, respectively. These results indicate that ackee pods are good sources of Sodium and Iron, when compared with *C. millenii*. The results also reveal that the levels of Lead, Chromium and Cadmium are very low in both samples, making them safe for human consumption.

***Keywords*:** *Cola millenii*, *Blighia sapida*, Mineral nutrient

1. INTRODUCTION

Blighia sapida K.D. Koenig belongs to the Sapindaceae family [2], commonly known as "ackee" and "Ishin" in Yoruba language. The plant is known to be native to West Africa, it is also found in Central America and South Florida [4, 15, 21]. A tropical evergreen tree, it grows

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up to 10-15 m, with the ability to resist drought and can grow in most soil types [14, 17]. The fully matured fruit has a reddish pod which splits open to reveal two to four (but more commonly three) cream to yellow, fleshy and glossy arils, with smooth shiny black seeds [17]. Only the mature fruits, with naturally opened pods are edible. The unripe fruit pods is known to contain high levels of the toxic amino acid, hypoglycin A, consumption of which leads to a condition known as the "Jamaican Vomiting Sickness" (JVS) [4, 6]. As the fruits ripen, the concentration of hypoglycin A reduces appreciably. The ackee plant is known to possess medicinal and Pesticidal properties, and can also be used in the manufacturing of soaps [9, 11, 16, 17]. Various parts from ackee which include the roots, bark, leaves, capsules/pods and seeds were identified in the treatment of 22 diseases in Ashanti region of Ghana.

Fig. 1. Ripe pods of *Blighia sapida* K.D. Koenig

Cola millenii K. Schum belongs to the family called Sterculeaceae and commonly known as "Monkey cola" in English and "Obi-edun" in Yoruba. In Nigeria, people eat *C. millenii* as food and in combination with other plants for medicinal use.

Fig. 2. Open pods of *Cola millenii* K. Schum

Over the years, different medicinal plants parts have been used to cure various ailments [1]. Medicinal plants serve as an indispensable constituent of human diet supplying the body with mineral salts, vitamins and certain hormone precursors, in addition to protein and energy [3]. Substances that are therapeutic in nature and precursors for the synthesis of useful drugs are present in medicinal plants [19, 22-25].

Minerals are chemical constituents used by the body in many ways; they yield no energy but play an important role in the body activities [13]. Minerals are classified as macro (major), or micro (minor) elements.

The third category are the ultra trace elements. Macro minerals include: sodium, calcium, phosphorus, and chloride, while micro elements include: potassium, iron, zinc, manganese, selenium, molybdenium, flouride, cobalt, copper. Macro elements are required in amounts greater than 100 mg/dL and micro elements in amounts less than 100 mg/dL [12]. Micronutrients deficiencies are a major public health problem in many developing countries, for instance iron deficiency is associated with impaired cognitive performance, lowered work capacity, lower immunity to infections, pregnancy complication, etc. [7].

Mineral elements play important roles in health and disease states of humans. For instance, iron deficiency has been implicated in anemia, iodine in goiter [18]. Zinc and selenium are important to people with HIV, selenium is an antioxidant that increases immune function.

Adequate scientific knowledge on the nutritional benefit of mineral elements constituents from *B. sapida* and *C. millenii* pods could ensure that the fruits from this plant trees are well improved for commercial purposes. This study, therefore, aims to comparatively investigate the nutritional elements of *B. sapida* and *C. millenii* pods from Nigeria.

2. MATERIALS AND METHODS

2. 1. Collection of pods sample

The biological materials used for this study are from ackee (*Blighia sapida* K.D. Koenig) and *Cola millenii* K. Schum. Pods samples were collected from Onigambari research station of the Forestry Research Institute of Nigeria, Oyo state (**Fig. 1** and **Fig. 2**). They were immediately transported to the Laboratory of Soil Department, Forestry Research Institute of Nigeria and stored under prevailing tropical ambient conditions before the preparation of powder from raw materials.

2. 2. Sample Preparation

The ackee *Blighia sapida* and *Cola millenii* were thoroughly sorted to remove bad ones. The selected pods were washed with clean water to eliminate adhering dirt and extraneous materials, and then they were dried in an oven at 65 °C for 48 hours. Then dried pods were ground into powder, sieved with 25 μm mesh sieve, and stored in bottles in an oven at 55 °C for different analyses.

2. 3. Analytical Procedure

Apparatus: Block-digester, Vortex tube stirrer, Atomic Absorption Spectrophotometer, Flame photometer.

2. 4. Procedure

Weigh 1 g oven dried and ground plant material, then transfer quantitatively into a 100-mL Pyrex digestion tube. Add 1 mL (2:1) Nitric acid and Perchloric acid mixture and allow to stand overnight or until vigorous reaction phase is over. Place small and short – stemmed funnels in the mouth of the tubes to reflux acid, after the preliminary digestion, place the tubes in a cold block-digester and then raise the temperature to 150 ºC for 1 hour. Place the U-shaped glass rods under each funnel to permit exit of volatile vapors'. The temperature was increased slowly until all traces of HNO_3 disappear, the U-shaped glass rods was then removed.

Raise temperature to 235 ºC when the dense white fumes of $HClO_4$ appear in the tubes, continue digestion for 30 minutes more. The tubes rack was lifted out of the Block digester and a few drops of distilled water were carefully added through the funnel. After vapors condense, distilled water was added in small increments to wash down walls of the tubes and funnels. Bring to volume, the solution of each tube was mixed, and then leave undisturbed for a few hour. The mineral elements were then determined using Atomic absorption spectrophotometer.

3. RESULTS AND DISCUSSION

The mineral element composition of *B. sapida* and *C. millenii* is shown in **Table 1**. The result shows that the level of sodium 1.325% in *B. sapida* is higher when compared to 0.663% of sodium present in *C. millenii*. Sodium maintains the osmotic pressure of body fluids [10, 12].

The term hypernatraemia, elevated level of sodium in the serum occurs in Cushions disease, administration of sex hormones, adrenocorticotrophic hormones and after active sweating [13]. The present study revealed that *B. sapida* contains a higher amount of potassium (0.077%) compared to *C. millenii* (0.013%). Potassium is the principal catch ion in intracellular fluid and function in acid-base balance, muscle contraction particularly the cardiac muscles. Potassium is also needed during glycogenesis.

The value obtained for Na/K ratio is far above the recommended value in these samples, calcium was higher in *B. sapida* (0.032%) than the amount present in *C. milleni* (0.019%). Calcium is a major component of the body bone and teeth structure, in blood coagulation, calcium activates the conversion of prothrombin to thrombin. Calcium activates a large number of enzymes, including adenosine triphosphate (ATPase), lipase, Succinic dehydrogenase, etc. It allows muscle contraction, neuromuscular excitability, among others. Calcium and phosphorus are absorbed mainly in the duodenum and the amount absorbed depends on calcium – phosphorus ratio and intestinal pH.

The level of phosphorus in the present study revealed that *B. sapida* contains higher amount of phosphorus (0.017%) when compared with *C. millenii* phosphorus (0.004%). The ratio of *B. sapida* Ca/P is greater than 1, indicating that the pods of this plant would serve as a good source of minerals for bone formulation. However, that of *C. millenii* is significantly above the recommended value.

The level of magnesium in *B. sapida* is slightly higher (0.033%) compared to *C. millenii* (0.013%). Oxidative phosphorylation is highly reduced in the absence of magnesium. It is also an important constituent of bones, teeth and enzymes cofactor [12].

The present study further observed that *B. sapida* contains a significantly higher level of iron (0.135%) compared to *C. millenii* (0.045%). Iron functions as hemoglobin in the transport of oxygen. Iron is involved in the synthesis and packaging of neurotransmitters, their uptake

and degradation into other iron-containing proteins which may directly or indirectly alter brain function [5]. The level of copper in *C. millenii* was observed to be higher (0.086%) compared to *B. sapida* with (0.054%). Copper is an essential micro-nutrient necessary for the hematologic and neurologic systems [20]. Copper play an important role in iron absorption [8].

The level of trace elements manganese, zinc, lead, chromium, and cadmium in *C. millenii*, were (0.001%, 0.006%, 0.006%, 0.0002%, and 0.00002%), respectively, compared to *B. sapida* (0.003%, 0.005%, 0.004%, 0.003%, and 0.00008%), respectively. This result showed that the plant samples are both safe for human consumption owing to the insignificant amount of lead present in both samples.

Table 1. Percentage Concentration of mineral elements of *B. sapida* and *C. milleni*

	Na%	Ca%	Mg%	K%	P%	Fe%	Cu%	Mn%	Zn%	Pb%	Cr%	Cd%
C. milleni	0.663	0.019	0.013	0.013	0.004	0.045	0.086	0.001	0.006	0.006	0.0002	0.00002
B. sapida	1.325	0.032	0.033	0.077	0.017	0.135	0.054	0.003	0.005	0.004	0.003	0.00008

4. CONCLUSION

In conclusion, the result of this research work showed that both *C. milleni* and *B. sapida* pods are good sources of sodium but more importantly *B. sapida* pod is very rich in iron and a good source of potassium both of which are essential in blood and ATP formation, respectively. Also *C. milleni* is rich in copper a nutrient that is very important in iron absorption. Also the level of lead in both samples is reasonably low which further confirms that both are safe for human consumption.

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Reference

[1] Abubakar, M.G., Yerima, M.B., Zahriya, A.G., and Ukwuani, A.N. (2010). Acute toxicity and antifungal studies of ethanolic leaves, stem and pulp extract of Tamarindus

indica. *Research Journal of Pharmaceutical, Biological And Chemical Sciences* 1(4): 104-111

[2] Adams, C.D. (1972). Flowering Plants of Jamaica, University of the West Indies (Mona), Kingston, Jamaica.

[3] Amaechi, N.C. (2009). Nutritive and anti-nutritive evaluation of wonderful kola (Buccholzia coricea) seeds. *Pak. J. Nut.* 8: 1120-1122

[4] Barceloux, D.G. (2008). Ackee fruit and Jamaican vomiting sickness, In Barceloux, D.G. (ed.), Medical Toxicology of Natural Substances: Foods, Fungi, Medicinal Herbs, Toxic Plants, and Venomous Animals, John Wiley & Sons Inc., New Jersey, pp. 318-326.

[5] Beard, J.L. (2001). Iron biology in immune function, muscle metabolism and neuronal functioning. *J. Nutr.* 131: 5685-5695

[6] Blake, O. (2003), Chemical and Toxicological Characterization of Selected Components of the Ackee (Blighia sapida) Fruit, M.Phil. Thesis (Unpublished), Department of Chemistry, University of the West Indies Mona, Kingston, Jamaica.

[7] Batra, J. and Seth, P.K. (2002).Effect of iron deficiency on developing rat brain. *Indian. J. Clin. Biochem.* 17 (2): 108-1114

[8] Chandra, R.K. (1990). Micro-Nutrients and immune functions: An overview. *Annal New York Acad. Sci.* 587: 9-16.

[9] Ekue, M.R.M., Sinsin, B., Eyog-Matig, O., and Kinkeldey, R. (2010). Uses, traditional management, perception of variation and preferences in ackee (Blighia sapida K.D. Koenig) fruit traits in Benin: implications for domestication and conservation. *Journal of Ethnobiology and Ethnomedicine*, Vol. 6, 12. http://www.ethnobiomed.com/content/6/1/12

[10] Hays, V.W. and Swenson, M.J. (1985). Minerals and Bones. In: Dukes' Physiology of Domestic Animals, Tenth Edition pp. 449-466.

[11] Khan, A., Gumbs, F.A., and Persad, A. (2002). Pesticidal bioactivity of ackee (Blighia sapida Koenig) against three stored-product insect pests. Tropical Agriculture (Trinidad), Vol. 79, No. 4, pp. 217-223.

[12] Murray, R.K., Granner, D.K., Mayes, P.A., and Rodwell, V.W. (2000). Harper's Biochemistry, 25th Edition, McGraw-Hill, Health Profession Division, USA.

[13] Malhotra, V.K. (1998).Biochemistry for students. Tenth Edition. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi, India.

[14] Morton, J.F. (1987), Fruits of Warm Climates, Julia Morton, Miami, FL.

[15] Ouattara, H., Niamke, B., Dally, T., and Kati-Coulibaly, S. (2010). Nutritional composition studies of sun dried Blighia Sapida (K. Koenig) aril from Cote d'Ivoire. *Journal of Applied Bioscience*, 32, pp. 1989-1994

[16] Oladiji, A.T., Shoremekun, K.L., and Yakubu, M.T. (2009). Physicochemical properties of the oil from the fruit of Blighia sapida and toxicological evaluation of the oil-based diet in Wistar rats. *Journal of Medicinal Food*, Vol. 12, No. 5, pp. 1127-1135.

[17] Omobuwajo T.O., Sanni L.A., and Olajide J.O. Physical properties of ackee apple (Blighia sapida) seeds. *Journal of Food Engineering* 2000, 45: 43-48. 10.1016/S0260-8774(00)00040-6

[18] Patwardhan, V.N. (1961). Nutritionin in India. Bombay. *Indiand Journal of Medical Sciences*, 2nd ed. 515 pp.

[19] Sofowora, A., (1982). Medicinal plants and Traditional medicine in Africa: John Wiley & Sons Ltd., 1-10. Substantial equivalence of antinutrients and inherent plant toxins in genetically modified foods. *Food Chem.* 38: 473-483

[20] Tan, J.C., Burns, D.L., and Jones, H.R. (2006). Severe ataxia, myelopathy and peripheral neuropathy due to acquired copper deficiency in a patient with history of gastrectomy. *J. Paenteral Nutr.* 30: 446-450

[21] Djenontin S.T., Wotto V.D., Lozano P., Pioch D., and Sohounhloué D.K.C. Characterisation of Blighia sapida (Sapindaceae) seed oil and defatted cake from Benin. *Natural Product Research: Formerly Natural Product Letters* 2009, 23: 549-560

[22] Adebola, P.O. and Morakinyo, J.A. Evaluation of Morpho-agronomic Variability of Wild and Cultivated Kola (*Cola* Species Schott et Endl.) in South Western Nigeria. Genetic Resources and Crop Evolution June 2006, Volume 53, Issue 4, pp 687–694. https://doi.org/10.1007/s10722-004-3558-1

[23] Violaine Nicolas, Armand Natta, Patrick Barrieré, Arnaud Delapre, and Marc Colyn. Terrestrial small mammal diversity and abundance in central Benin: comparison between habitats, with conservation implications. *African Journal of Ecology* Volume 48, Issue 4 December 2010 Pages 1092-1104. https://doi.org/10.1111/j.1365-2028.2010.01221.x

[24] Joseph Ikechukwu Muoghalu and Oluwabumi Okerinmola Okeesan. Climber species composition, abundance and relationship with trees in a Nigerian secondary forest. *African Journal of Ecology* Volume 43, Issue 3 September 2005 Pages 258-266. https://doi.org/10.1111/j.1365-2028.2005.00585.x

[25] Morakinyo J.A. (1995) Gene exchange between *Cola millenii* and *Cola nitida:* hybridization and hybrid seed viability. *Biosci Res Commun* 7(2): 151–153